

3.1 rate of change - instantaneous and average

2014-09-30 day 25

Average Velocity

this is what you have always known
as "velocity"

If position is described by a function of
time, call it $s(t)$ [remarks about s for position],
then average velocity = $\frac{s(t_1) - s(t_0)}{t_1 - t_0} = \frac{s(t_0) - s(t_1)}{t_0 - t_1}$
between t_0 and t_1

$s(t_1) - s(t_0)$ is called the displacement,
between t_0 and t_1

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(NY)
I used to drive to Poughkeepsie to visit my parents. A major part of my trip was on the NJT. (They told me how far the trip was. [I loved this]. (on the toll ticket)
Let's say I traveled ^{North} 135 mi. in 2 hrs.
What was my average velocity?

Velocity is a signed quantity - it describes motion in a particular direction.

What was my average speed? [If I left one of the service plaza going South (I was arguing with my wife and didn't notice), got off at the next service plaza 25 miles south, and fixed my direction]

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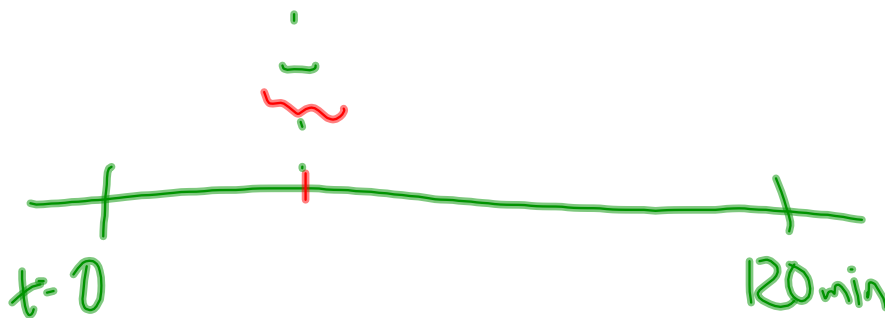
Knowing my average speed is 67.5 (oops) mph,
Can I argue with the policeman that pulls me
over (Alexa was actually driving at the time)
when he tells me the car was moving
87mph?

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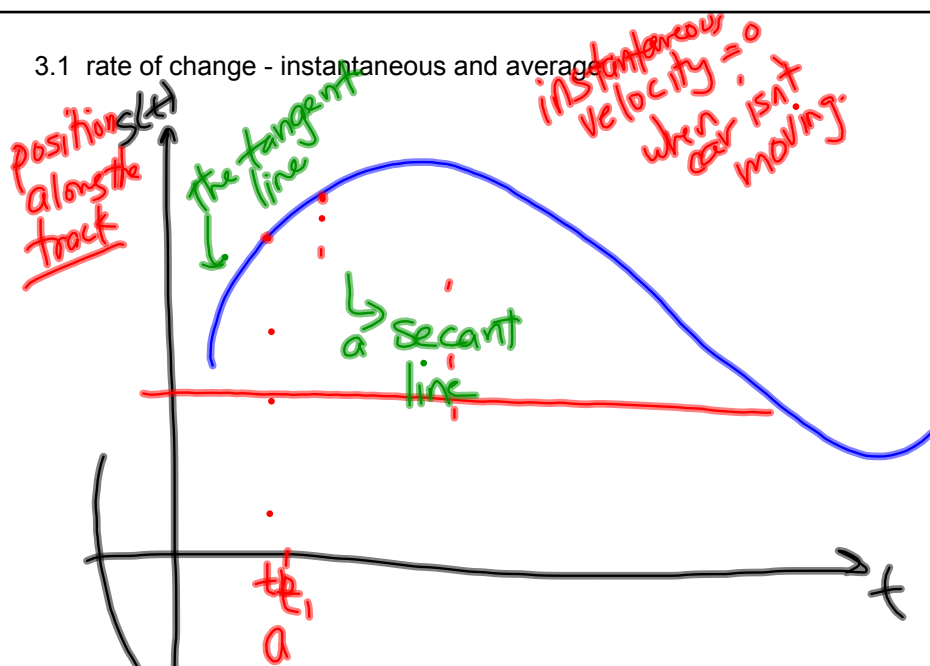
The instantaneous velocity of $s(t)$ at time $t=a$ is ---

$$\lim_{t \rightarrow a} \frac{s(t) - s(a)}{t - a}$$



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$$\frac{s(t_1) - s(t_0)}{t_1 - t_0}$$

[[also the
slope
formula]]

[[also called
difference
quotient]]

$$\begin{aligned} \text{slope} &= \text{instantaneous} \\ &\text{velocity} \\ &= \text{instantaneous} \\ &\text{rate of} \\ &\text{change} \end{aligned} = \lim_{t \rightarrow a} \frac{s(t) - s(a)}{t - a}$$